

### PROVISIONAL SUNSPOT RELATIVE NUMBERS FOR JULY 1938

[Dependent alone on observations at Zurich]

[Data furnished through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

July 1: Great eruptive prominence on west limb.

July 3: Middle large bright chromospheric eruption at 13<sup>h</sup> 30<sup>m</sup> to 13<sup>h</sup> 38<sup>m</sup> U. T., east.

July 4: Middle large bright chromospheric eruptions (2 centers) at 7<sup>h</sup> 10<sup>m</sup> to 7<sup>h</sup> 20<sup>m</sup> and 12<sup>h</sup> 00<sup>m</sup> to 12<sup>h</sup> 35<sup>m</sup>, west.

July 5: Middle bright chromospheric eruption at 13<sup>h</sup> 45<sup>m</sup> to 14<sup>h</sup> 10<sup>m</sup>, west.

July 10: Large bright chromospheric eruption at 15<sup>h</sup> 32<sup>m</sup> to 15<sup>h</sup> 37<sup>m</sup>, central zone.

July 28: Great eruptive prominence on west limb at 13<sup>h</sup> 58<sup>m</sup> to 15<sup>h</sup> 35<sup>m</sup>.

July 1938	Relative numbers	July 1938	Relative numbers	July 1938	Relative numbers
1-----	<i>ad</i> 119	11-----	205	21-----	147
2-----	<i>Eac</i> —	12-----	<i>a</i> 211	22-----	<i>Ec</i> 118
3-----	<i>a</i> 157	13-----	229	23-----	<i>Macd</i> 157
4-----	<i>dd</i> 151	14-----	<i>Ebc</i> 208	24-----	<i>aad</i> —
5-----	141	15-----	<i>a</i> 200	25-----	202
6-----	<i>Ecd</i> 184	16-----	173	26-----	<i>a</i> 179
7-----	<i>b</i> 175	17-----	161	27-----	156
8-----	<i>d</i> 186	18-----	<i>d</i> 148	28-----	<i>a</i> 151
9-----	<i>d</i> 175	19-----	<i>Eac</i> 151	29-----	<i>aa</i> 151
10-----	<i>ab</i> 183	20-----	<i>EMcc</i> 153	30-----	<i>a</i> 139
				31-----	109

Mean, 29 days = 166.2

*a* = Passage of an average-sized group through the central meridian.

*b* = Passage of a large group or spot through the central meridian.

*c* = New formation of a group developing into a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central circle zone.

*d* = Entrance of a large or average-sized center of activity on the east limb.

### AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE in Charge]

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The mean free-air data for the month of July 1938, given in table 1, are based on a total of 366 airplane and radiometeorograph observations. They include the basic meteorological elements of barometric pressure (P), temperature (T), and relative humidity (R. H.), recorded at certain geometric heights. The reduced number of observations obtained in July was unavoidable because of the hiatus that existed when certain airplane stations were discontinued and radiometeorograph observations substituted therefor.

These "means" are computed by the customary method of differences, but are omitted whenever less than 15 observations have been made at the surface and less than 5 at a standard height. At those levels, however, which fall within the limits of the monthly vertical range of the tropopause, at least 15 observations are necessary. For further details, see "Aerological Observations," in the January 1938, issue of the MONTHLY WEATHER REVIEW.

Chart I, published elsewhere in this REVIEW, shows the departure of mean surface temperature from the normal. The temperature was slightly in excess of normal over most of the country, particularly so in the far Northwest, where it was decidedly warm (+6° F.), and in the Central Plains States, where it was moderately warm (+4° F.). In the Southeast, western Texas, and New Mexico, the mean temperature was slightly below normal (−2° F.).

Free-air mean temperatures at all levels above the surface, for all but one station in the United States, ranged seasonally higher than during the preceding month of June. The greatest positive differences in mean free-air temperatures for July over June were noted at San Diego, Calif., at 1 kilometer (5.7° C.); over Spokane, Wash., at 1.5 and 2 kilometers (5.4° C. and 5.2° C., respectively); over Seattle, Wash., at 2.5, 3, and 4 kilometers (4.9° C., 4.5° C., and 4.2° C., respectively); and over Washington, D. C., at 5 kilometers (3.2° C.). The only negative free-air temperature differences for July over June, occurred over El Paso, Tex., at 1.5, 2, 2.5, and 3 kilometers (0.9° C., 1.1° C., 1.0° C., and 0.9° C., respectively). July temperatures were slightly lower, however, than during the corresponding month in 1937, except over Seattle, Wash., where July 1938 averaged at least 3° C. warmer at all levels.

Temperatures were highest over the Southeast at 0.5 kilometer, and remained high also over the Southern Rocky Mountain States and California at all other levels. The lowest mean free-air temperatures occurred over the North Atlantic States and the far Northwest at all levels. Actually, the highest temperatures for the current month were recorded over Pensacola, Fla., at 0.5 kilometers; over San Diego, Calif., and Spokane, Wash., at 1 kilometer; over Salt Lake City, Utah, at 1.5, 2 and 2.5 kilometers; over San Diego, Calif., and Salt Lake City, Utah, at 3 kilometers; over San Diego, Calif., at 4 kilometers; and over El Paso, Tex., at 5 kilometers. The highest mean temperature of the month (23.6° C.) occurred over Pensacola, Fla., at 0.5 kilometer, while the lowest of the month (−7.8° C.) was recorded over Lakehurst, N. J., at 5 kilometers. Also, low temperatures were recorded over Lakehurst, N. J., and Seattle, Wash., at all levels above 0.5 kilometer.

Isobaric charts, prepared from the mean barometric pressures in millibars, as given in table 1, show that in July pressure was high over the Southeast and far Northwest up to 2 kilometers, and above that level over the Southern States. At 2.5 and 3.0 kilometers pressures were uniformly distributed in a belt across the central United States, extending from the Atlantic to the Pacific. During July mean pressures varied but little from those recorded in June, except they were somewhat greater in the lower levels, and definitely so at 4 and 5 kilometers. A slight statistical center of low atmospheric pressure existed in the lower levels over Norfolk, Va., but shifted northward to Lakehurst, N. J., and then to New England at the higher levels.

The distribution of free-air relative humidity (table 1) varied considerably from that noted during the preceding month. The humidity at all levels was definitely in excess of that observed in June, and also higher than during the corresponding month of 1937, particularly at the upper levels. The relative humidity was greatest in the lower levels over Pensacola, Fla., and above 3 kilometers at El Paso, Tex. Lower humidities prevailed over Seattle and Spokane, Wash., and southern California, at all levels, while moderately high humidities occurred over the North Atlantic States.

At 3 kilometers a 65-percent relative humidity existed over the central, southeastern, and southern portions of the country. This condition existed generally up to 4 and 5 kilometers, and then increased slightly in value over the Southwestern States, to more than 70 percent at El Paso, Tex., at 5 kilometers.

Free-air resultant winds, based on pilot-balloon observations made near 5 a. m. (75th meridian time) during the month of July, are shown in table 2. Upper-air winds for July showed that the greatest departures from normal directions were located in the extreme southeastern portion of the country, notably over Pensacola and Key West, Fla. During the preceding month the greatest departures had been observed at Seattle, Wash., and Medford, Oreg., but the winds at those stations for July, however, showed nearly normal conditions with one or two exceptions. Other stations reporting moderate departures in direction were: Atlanta, Ga., Washington, D. C., Sault Ste. Marie, Mich., Houston, Tex., and Albuquerque, N. Mex.

Of all the upper-air winds recorded in July, 44 percent were from an easterly direction at the surface. At 1 kilometer, however, only 5 percent were easterly, but this quickly increased again to 21 percent easterly at 2 kilometers, and even at 5 kilometers 20 percent of the observations had an easterly component. Fifteen stations obtained the required number of observations at 5 kilometers during July, while only one failed to reach 3 kilometers.

Pensacola, Fla., showed the widest departures from normal resultant directions in July. These directions were: 217° at the surface; 223° at 0.5 kilometer; 192° at 1 kilometer; 186° at 1.5 kilometers; 137° at 2 kilometers; 140° at 2.5 kilometers; and 39° at 3 kilometers, as compared to the normal directions of 296°, 265°, 251°, 235°, 224°, 222°, and 220°, respectively. The current directions were all south of normal (when rotated counterclockwise), and at 3 kilometers the resultant wind direction reached a position opposite to the normal. At Key West, Fla., entirely reversed conditions obtained, for it was noted that the departures at all levels were north of normal (when rotated clockwise). Wide variations in departure occurred over Key West, Fla., and the differences between the current month and its normal were: 10°, 6°, 11°, 15°, 30°, 36°, 42°, 118°, and 142°, from the surface to 5 kilometers, respectively.

The outstanding differences between the July resultant wind directions and their normals for each level over the

United States were: 120° north of normal at the surface (when rotated in a clockwise direction) at Sault Ste. Marie, Mich.; 65° south of normal (counterclockwise), also over Sault Ste. Marie, Mich.; 69° north of normal over Fargo, N. Dak.; 49° south of normal over Pensacola, Fla.; 144° south over Medford, Oreg.; 82° south over Pensacola, Fla.; directly opposite the normal, also over Pensacola, Fla.; and 118° and 142° north of normal over Key West, Fla.; all at the surface, 0.5, 1.0, 1.5, 2.0, 2.5, 3, 4, and 5 kilometers, respectively.

St. Louis, Mo., Omaha, Nebr., and Chicago, Ill., all showed the smallest wind direction departures, and at no level over St. Louis, Mo., was the departure difference more than 7°. Pensacola, Fla., Washington, D. C., Newark, N. J., and Detroit, Mich., showed southerly departures at all levels, when rotated counterclockwise from normal, while Key West, Fla., and Houston, Tex., showed northerly departures, when rotated clockwise. Atlanta, Ga., recorded large southerly departure differences which gradually decreased up to 2 kilometers, and then small northerly departure differences that increased in amount steadily up to 5 kilometers. These interesting departure differences were: -42°, -48°, -35°, -20°, -1°, +10°, +64°, +62°, and +76°, reading from the surface to 5 kilometers, respectively.

During July small departures in resultant wind velocities were noted in the lower levels over the United States, but larger departures occurred at the higher levels. Over Medford, Oreg., less-than-normal, or negative, differences of 2.6 and 5.0 m. p. s. were observed at 4 and 5 kilometers, respectively; over Newark, N. J., a positive difference of 3.5 m. p. s. at 4 kilometers; and over Spokane, Wash., negative differences of 3.0 and 3.5 m. p. s. at 4 and 5 kilometers, respectively. Over Pensacola, Fla., all variations in resultant wind velocities for July were greater than normal, but over Key West, Fla., where the departures in direction were the opposite to those recorded at Pensacola, Fla., the wind velocity departures were less than normal at all levels.

Table 3 shows the maximum free-air wind velocities recorded in July. The highest velocity occurred over Las Vegas, Nev., where the wind speed reached 52.2 m. p. s. (117 miles per hour) from the SSW on the 30th at 19.8 kilometers. Wind velocities of 46.4, 42.4 and 40.0 m. p. s. were recorded at Sault Ste. Marie, Mich., Modena, Utah, and Richmond, Va., respectively, at levels higher than 7 kilometers.

TABLE 1.—Mean free-air barometric pressure (*P*) in mb., temperature (*T*) in °C., and relative humidities (*R. H.*), in percent, obtained by airplanes and radiometeorographs during July 1938

Stations	Altitude (meters) m. s. l.																											
	Surface			500			1,000			1,500			2,000			2,500			3,000			4,000			5,000			
	Number of obs.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.	P	T	R. H.
Billings, Mont. <sup>1</sup> (1,090 m)	31	893	17.5	70							852	19.2	54	803	16.6	51	758	13.1	53	713	9.4	57	632	2.4	58	557	-4.7	56
Cheyenne, Wyo. <sup>1</sup> (1,873 m)	31	816	14.0	72										804	16.4	62	758	15.2	56	714	11.9	55	633	4.2	61	559	-4.2	67
Chicago, Ill. <sup>1</sup> (187 m)	31	992	19.4	87	957	21.7	68	904	19.5	67	852	16.4	67	804	13.6	67	757	10.7	62	713	7.9	58	631	2.1	52	557	-4.4	51
Coco Solo, C. Z. <sup>1</sup> (15 m)	27	1,009	24.9	93	955	23.3	87	902	20.4	86	851	17.9	80	803	15.4	77	756	13.5	66	713	11.1	59	630	4.5	68	558	-1.2	65
El Paso, Tex. <sup>1</sup> (1,193 m)	21	884	22.0	64							853	22.0	59	805	19.2	62	760	15.9	64	716	12.4	69	634	5.3	77	561	-1.3	72
Lakehurst, N. J. <sup>1</sup> (39 m)	20	1,011	19.4	91	958	21.6	59	903	18.0	62	851	13.5	72	802	9.8	70	755	7.3	56	710	4.6	49	627	-1.3	45	564	-7.8	44
Norfolk, Va. <sup>1</sup> (10 m)	26	1,017	22.8	91	962	23.1	69	908	20.4	68	856	16.9	71	807	13.9	68	759	11.5	59	715	9.0	53	633	3.0	50	559	-4.3	47
Pearl Harbor, T. H. <sup>1</sup> (6 m)	31	1,016	23.2	81	960	21.7	78	906	18.3	85	854	16.3	75	805	14.4	64	758	12.9	47	714	11.0	37	633	6.5	30	560	-1.7	25
Pensacola, Fla. <sup>1</sup> (13 m)	26	1,016	24.2	94	960	23.6	86	907	20.6	78	856	17.5	76	807	14.4	78	760	11.4	76	716	8.9	66	633	3.4	62	560	-1.9	60
St. Thomas, V. I. <sup>1</sup> (8 m)	31	1,017	27.1	75	962	22.0	86	908	18.7	86	856	15.8	82	807	13.8	73	760	11.8	60	715	9.0	51	633	2.7	48	560	-2.3	48
Salt Lake City, Utah <sup>1</sup> (1,288 m)	31	872	18.2	54							852	22.8	40	804	20.2	38	758	16.6	41	715	12.9	43	633	5.3	50	560	-2.6	59
San Diego, Calif. <sup>1</sup> (10 m)	30	1,014	18.0	86	958	15.2	91	904	22.5	49	853	22.4	37	805	19.8	35	758	16.5	37	715	12.9	40	634	5.5	43	560	-2.2	48
Seattle, Wash. <sup>1</sup> (10 m)	24	1,018	20.2	61	962	16.0	72	907	16.4	57	855	15.1	48	806	13.2	44	758	10.8	36	714	7.8	33	636	1.5	31			
Spokane, Wash. <sup>1</sup> (597)	31	945	17.9	58							802	22.5	38	852	20.1	36	803	16.5	34	757	12.6	43	713	8.7	47	631	1.9	48
* Washington, D. C. <sup>1</sup> (13 m)	30	1,015	21.5	87	958	20.8	75	905	18.7	73	852	15.7	74	805	12.6	75	756	9.8	71	713	7.0	67	630	1.4	65	556	-4.3	59

Observations taken about 4 a. m. 75th meridian time, except by Navy stations along the Pacific coast and Hawaii where they are taken at dawn.

<sup>1</sup> Weather Bureau.

<sup>2</sup> Navy.

\* Observations by radiometeorograph. Stations not so marked have observations by airplane.

NOTE.—None of the means included in this table are based on less than 15 surface or 5 standard-level observations.

TABLE 2.—Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during July 1938

[Wind from N=360°, E=90°, etc.]

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,095 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (157 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (283 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Nashville, Tenn. (194 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Surface	16	0.5	237	0.9	281	1.5	244	1.7	269	2.6	250	0.7	36	0.4	248	1.0	177	0.8	207	0.7	132	2.1	152	0.1	198	1.4
500			235	2.7			277	6.8			241	3.3	263	1.8	252	3.0	121	7.7	216	7.7	128	4.4	256	.5	220	4.7
1,000			250	3.6			269	6.6			275	3.8	272	3.7	257	4.7	300	2.9	201	5.3	137	4.3	295	1.2	247	4.6
1,500			263	2.7	167	.8	275	7.5			284	5.2	271	4.1	267	5.5	301	3.6	185	3.5	140	3.3	359	.3	254	3.7
2,000	177	2.1	279	1.8	249	1.1	284	6.4	261	2.8	289	5.9	285	5.2	271	5.6	300	5.5	181	1.8	153	2.2	48	.6	265	3.6
2,500	201	1.5	287	1.2	291	2.8	286	7.5	218	2.8	289	6.1	283	4.6	273	6.3	297	7.0	180	1.0	164	2.0	228	1.9	286	3.5
3,000	278	.5	340	1.2	292	3.9	301	9.0	245	3.4	295	5.7	300	5.5	278	6.8	290	9.5	188	.6	169	1.9	219	3.7	286	3.0
4,000	19	.6	344	2.6	280	6.9	285	12.1	281	3.9	295	5.3	344	4.6	288	9.5	288	10.1	136	.6	252	1.1	241	4.2	294	2.6
5,000	46	.7	23	3.5	235	8.1			275	8.0					301	9.9			83	1.6	248	.7	302	3.8	312	3.4

  

Altitude (meters) m. s. l.	Newark N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Har- bor, Terri- tory of Hawaii <sup>1</sup> (68 m)		Pensacola, Fla. <sup>1</sup> (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washing- ton, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
Surface	229	1.3	302	1.9	167	2.4	152	1.0			217	0.8	219	1.0	153	3.6	360	1.9	142	0.3	128	0.4	80	1.7	237	0.5
500	260	4.8	266	3.1	183	4.2	206	2.1			223	2.8	239	3.1			351	1.2	209	1.0	33	2.2			253	4.5
1,000	266	9.0	297	3.3	208	8.1	239	5.3			192	3.1	264	4.2			331	1.5	251	3.5	355	2.6	214	3.1	263	4.8
1,500	260	7.4	238	2.7	219	4.9	266	5.8			186	1.5	279	4.1	153	5.2	271	1.7	256	4.1	336	3.1	236	4.3	265	5.2
2,000	264	9.9	212	3.6	233	3.0	264	6.2			137	1.2	295	4.0	177	2.9			271	4.6	259	1.4	238	4.7	271	5.3
2,500	272	9.0	202	4.3	254	.7	279	5.6			140	1.1	291	3.7	227	2.4			283	5.9	282	3.3	244	4.6	272	5.2
3,000	279	9.4	209	3.8	48	1.0	282	6.0			39	1.2	296	4.4	238	3.0			284	5.9	259	5.3	247	5.1	279	7.2
4,000	285	11.4			116	.3	283	6.0					295	5.0	258	4.6			308	7.8			238	5.6	282	7.7
5,000					245	1.0	304	6.0					290	5.0	261	4.8			304	8.7			271	5.6		

<sup>1</sup> Navy stations.

TABLE 3.—Maximum free air wind velocities (M. P. S.), for different sections of the United States based on pilot balloon observations during July 1938

Section	Surface to 2,500 meters (m. s. l.)				Station	Between 2,500 and 5,000 meters (m. s. l.)				Station	Above 5,000 meters (m. s. l.)				Station
	Maximum ve- locity	Direction	Altitude (m), m. s. l.	Date		Maximum ve- locity	Direction	Altitude (m), m. s. l.	Date		Maximum ve- locity	Direction	Altitude (m), m. s. l.	Date	
Northeast <sup>1</sup>	24.7	SW	1,540	23	Boston, Mass.	30.8	NW	3,820	2	Burlington, Vt.	38.0	WSW	11,500	19	Cleveland, Ohio.
East-Central <sup>2</sup>	27.5	WSW	1,870	1	Cincinnati, Ohio	26.2	NNE	3,810	12	Knoxville, Tenn.	40.0	NNW	11,490	4	Richmond, Va.
Southeast <sup>3</sup>	18.8	NE	340	4	Charleston, S. C.	19.3	SSW	3,000	29	Charleston, S. C.	34.0	N	12,540	5	Charleston, S. C.
North-Central <sup>4</sup>	28.9	NW	1,560	13	Huron, S. Dak.	33.6	NW	4,450	13	Huron, S. Dak.	46.4	NW	9,830	2	Sault Ste. Marie, Mich.
Central <sup>5</sup>	29.6	W	810	13	Chicago, Ill.	27.0	NW	3,700	11	Chicago, Ill.	32.0	NNW	10,420	29	Indianapolis, Ind.
South-Central <sup>6</sup>	27.6	SW	1,010	2	Oklahoma City, Okla.	25.6	NNE	4,410	31	Abilene, Tex.	35.6	NE	14,260	23	De Rio, Tex.
Northwest <sup>7</sup>	26.0	WSW	1,710	23	Billings, Mont.	27.0	WSW	4,900	30	Boise, Idaho	50.0	NW	9,140	4	Medford, Oreg.
West-Central <sup>8</sup>	21.6	SW	2,280	5	Modena, Utah	36.3	WSW	2,750	11	Rock Springs, Wyo.	42.4	SW	7,520	3	Modena, Utah.
Southwest <sup>9</sup>	20.5	WNW	2,300	18	Havre, Mont.	29.1	S	2,660	11	Winslow, Ariz.	52.2	SSW	19,780	30	Las Vegas, Nev.

<sup>1</sup> Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.<sup>2</sup> Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.<sup>3</sup> South Carolina, Georgia, Florida, and Alabama.<sup>4</sup> Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.<sup>5</sup> Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.<sup>6</sup> Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.<sup>7</sup> Montana, Idaho, Washington, and Oregon.<sup>8</sup> Wyoming, Colorado, Utah, northern Nevada, and northern California.<sup>9</sup> Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.